Key Findings and Public Health Messages

- The California Department of Public Health (CDPH) received reports of 424 cases of listeriosis with estimated symptom onset dates from 2009 through 2012. This corresponds to an average annual incidence rate of 0.28 cases per 100,000 Californians.
- During 2009-2012, listeriosis incidence rates in California were relatively stable, ranging from a minimum of 0.26 per 100,000 in 2009 and 2010 to a maximum of 0.32 per 100,000 in 2011.
- During the surveillance period, 60 (14.2 percent) case-patients were reported to have died with listeriosis.
- Average annual listeriosis incidence rates during the surveillance period were highest among adults 65 years of age or older (1.22 per 100,000) and children under 1 year of age (0.94 per 100,000).
- From 2009 through 2012, there were 5 multi-state foodborne outbreaks of listeriosis involving more than 28 California case-patients (as of February 2016).
- Improving the safety of food, such as soft cheeses and raw produce, and educational outreach to high-risk consumers such as pregnant women, the immunocompromised, and adults 65 years of age or older may provide the best opportunities for reducing listeriosis.

Background

In the United States (US), listeriosis is an uncommon but serious foodborne illness associated with an estimated 1,600 infections and more than 1,400 hospitalizations annually. Listeriosis is a leading cause of foodborne-related mortality in the US, with infection resulting in more than 250 deaths each year.[1] Listeriosis is caused by the bacteria *Listeria monocytogenes*, which is ubiquitous in the environment in soil, vegetation, and untreated water and can infect various animals. The national *Healthy People 2020* target objective for listeriosis is for an incidence rate lower than 0.20 new cases per 100,000 population.

Consuming foods contaminated with *Listeria* is the leading source of infection. *Listeria* has been found in raw foods, including unpasteurized milk and milk products, uncooked meats, and produce, and has also been found in foods that became contaminated after processing, such as ready-to-eat meats and soft cheeses.[2] Cooking and pasteurizing kills *Listeria*, but unlike other foodborne pathogens, *Listeria* will multiply in refrigerated temperatures.[3]

More than 90% of *Listeria* infections occur in immunocompromised persons, adults 65 years and older, and pregnant women and their newborns.[3] Onset of symptoms after exposure can range from as little as one day to more than two months.[4] Symptoms can vary but include gastroenteritis, fever, head and muscle aches, stiff neck and convulsions. Severe illness can result in meningoencephalitis, septicemia, and death. Most case-patients experience severe, invasive illness: immunocompromised persons and adults 65 years and older are at greatest risk. Although infected pregnant women often experience only a mild illness, infection during pregnancy can lead to premature delivery, miscarriage, stillbirth, or serious infection in the newborn.[3]

This report describes the epidemiology of confirmed *Listeria* infections in California with estimated symptom onset dates from January 1, 2009 through December 31, 2012. A description of listeriosis outbreaks involving California case-patients that occurred during 2009-2012 is also included. The year in which an outbreak occurred was defined as the earliest date of illness onset among the case-patients involved in an outbreak. A multi-state outbreak with the patients' year of illness onset ranging from 2010 to 2015 was included in the outbreak discussion. Both listeriosis cases and outbreaks were reported by February 2016. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to the *Technical Notes*.[5] The epidemiologic description of listeriosis for the 2001-2008 surveillance period can be found in the *Epidemiologic Summary of Listeriosis in California, 2001-2008*.[6]

California reporting requirements and surveillance case definitions

California Code of Regulations, Title 17, requires health care providers to report suspected cases of listeriosis to their local health department within one working day of identification or immediately by telephone if an outbreak is suspected. Laboratories are also required to report laboratory testing results suggestive of *Listeria* infection to either the California Reportable Disease Information Exchange (CalREDIE) (via electronic laboratory reporting) or the local health department; reporting must occur within one working day after the health care provider has been notified.

California regulations require local health officers to re-

port cases of listeriosis to CDPH. Cases were counted as confirmed by CDPH based on the Centers for Disease Control and Prevention (CDC)/Council of State and Territorial Epidemiologists' surveillance case definition of a confirmed case. During the surveillance period, a confirmed case of listeriosis was defined as one with *L. monocytogenes* isolated from a normally sterile site or, in the setting of a miscarriage or stillbirth, isolation of *L. monocytogenes* from placental or fetal tissue.[7]

Epidemiology of listeriosis in California

CDPH received reports of 424 cases of listeriosis with estimated symptom onset dates from 2009 through 2012. This corresponds to an average annual incidence rate of 0.28 cases per 100,000 Californians. Incidence rates during the 2009-2012 surveillance period were relatively stable, fluctuating within the same range as rates during the previous surveillance period [Figure 1]. Incidence rates ranged from a minimum rate of 0.26 per 100,000 (97 and 98 cases) in 2009 and 2010 to a maximum rate of 0.32 per 100,000 (121 cases) in 2011. During the surveillance period, 60 (14.2 percent) case-patients were reported to have died with listeriosis.

Average annual listeriosis incidence rates during 2009 -2012 were highest among adults 65 years of age or older (1.22 per 100,000, not shown) and children under 1 year of age (0.94 per 100,000) [Figure 2]. The ratio of female to male cases was 1.3:1.0. Incidence rates by race/ethnicity were not calculated due to the substantial portion of missing data (14.4 percent). However, listeriosis cases with complete information reported White non-Hispanic and Asian/Pacific Islander race/ethnicities more frequently than would be expected and Hispanic ethnicity less frequently than would be expected based on the demographic profile of California [Figure 3].

County-specific average annual listeriosis incidence rates during the surveillance period ranged from 0 to 0.93 per 100,000 [Figure 4]. Average annual incidence rates were similar in Northern California (0.31 per 100,000) and Southern California (0.26 per 100,000). During 2009 through 2012, 19 counties reported average annual incidence rates that were above the Healthy People 2020 target objective.

From 2009 through 2012, there were 5 foodborne outbreaks of listeriosis involving more than 28 California case-patients. For each of the outbreaks, California was one of multiple states where exposure occurred. Among 4 outbreaks with a confirmed food vehicle, soft cheese (made with pasteurized and unpas-

Figure 1. California listeriosis case counts and incidence rates by estimated year of illness onset

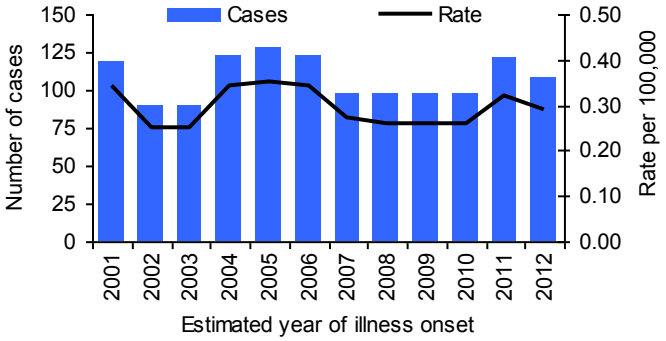


Figure 2. California listeriosis average annual incidence rates by age group, 2009—2012

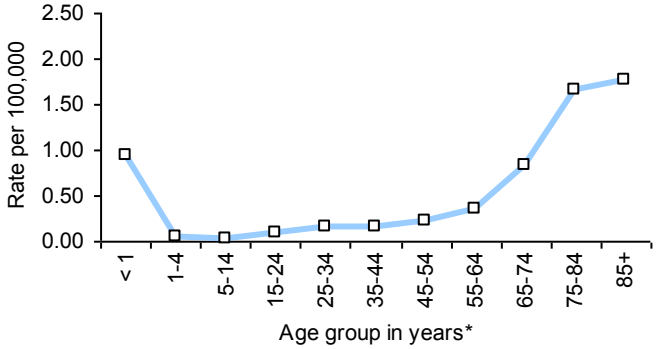
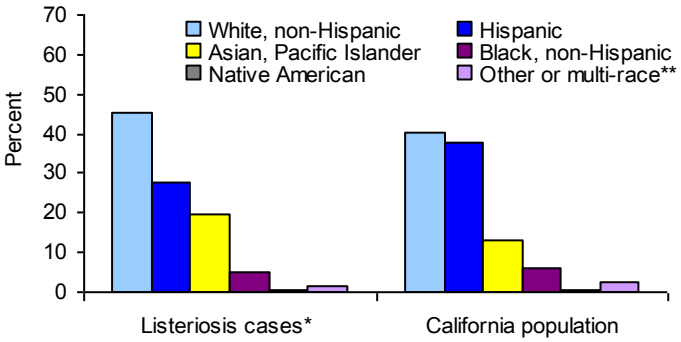


Figure 3. California listeriosis cases and population by race/ethnicity, 2009 - 2012

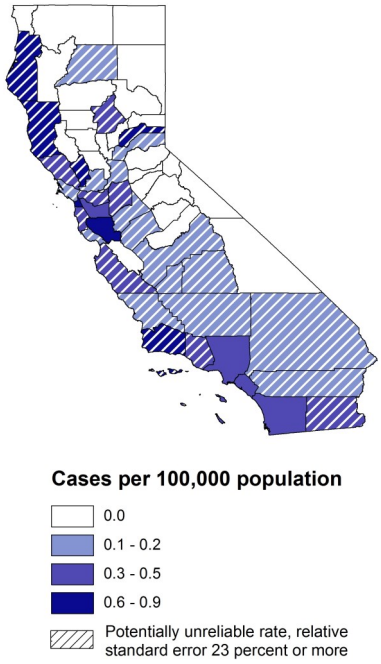


Notes for Figures 1-4

*Unknowns were excluded

**Includes cases who identified 'other' as their race and Californians ('population') who identified more than one race

Figure 4. California county-specific listeriosis average annual incidence rates, 2009—2012



teurized milk) was implicated in 3 outbreaks, and whole cantaloupe was implicated in 1 outbreak.

One of the 5 multistate *Listeria* outbreaks described above involved 34 case-patients reported from 10 states with illness onset ranging from 2010 to 2015 (including 21 California case-patients, 2 of whom died). This outbreak was first identified by CDC in 2015 when a cluster of patients were found to be infected with a rare strain of *Listeria*. Advanced genetic testing (whole genome sequencing (WGS)) subsequently linked earlier cases to the outbreak. Illnesses were associated with the consumption of various types of pasteurized cheeses sold under multiple brand names by a company in California. Environmental samples taken from the company's production facility in 2010 and 2015 matched the patient laboratory specimens by WGS. Four California patients had illness onset during the 2009-2012 surveillance period.

Comment

Incidence rates of reported listeriosis among Californians were relatively stable from 2009 through 2012. Each year during the surveillance period, the statewide incidence rate of listeriosis was greater than the national Healthy People 2020 target objective.

The age and gender distribution of reported cases incident in California during 2009-2012 remained fairly consistent with that of 2001-2008, although children under 1 year of age had a slightly lower incidence during this surveillance period.[6] Comparable to national trends, California children under 1 year of age and adults 65 years of age or older experienced the highest rates of listeriosis.[8]

Improving the safety of foods, such as soft cheeses and raw produce, and educational outreach to high-risk consumers such as pregnant women, the immunocompromised, and adults 65 years of age and over may provide the best opportunities for reducing the incidence of listeriosis. Additionally, continued surveillance of human infections, especially in combination with enhanced molecular characterization of infecting strain types, may help detect dispersed, previously unrecognized disease clusters.

References and resources

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[3]Centers for Disease Control and Prevention. *Listeria* (Listeriosis). http://www.cdc.gov/listeria/index.html (accessed on 6/1/2016)

[4]Goulet V, King LA, Vaillant V et al. What is the incubation period for listeriosis? BMC Infect Dis. 2013 Jan 10;13:11.

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[7]National Notifiable Diseases Surveillance System, Case Definitions, Listeriosis. Centers for Disease Control and Prevention. http://wwwn.cdc.gov/nndss/conditions/listeriosis/ (accessed on (6/1/2016)

[8]Adams DA, Jajosky RA, Ajani U et al. Summary of notifiable diseases--United States, 2012. MMWR Morb Mortal Wkly Rep. 2014 Sep 19;61(53):1-121.

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